

REMARKS:

- 1) The insertion of the subheadings into the PCT specification and the conforming of the Summary of the Invention to new claim 12 are of an editorial nature and do not contain any new matter.
- 2) Claim 1 has been previously canceled.
- 3) The new claims are supported by the original claims and the original disclosure as follows.

New Claims	12	13	14	15	16	17	18	19	20	21	22
Original Support	cl. 7, pg. 9, ln. 6	Fig. 2	cl. 7	cl. 8	cl. 7	cl. 9	cl. 10	cl. 11	pg. 9, ln. 13, 14	pg. 8, ln. 28; pg. 9, ln. 1	pg. 7, ln. 23

The new claims 12 to 22 do not contain any new matter. The qualifier "highly" for the adjective "viscous" has been omitted from claim 12.

- 4) With regard to the double patenting rejection as set forth in sections 2 and 3 on pages 2 and 3 of the Office Action, applicants are enclosing a copy of an Assignment which assures that the present application and US Serial Number 10/466,031 are commonly owned by the same entity, namely Conti Temic microelectronic GmbH. A copy of the enclosed Assignment has been forwarded to the USPTO for recording. At this time we do not yet have a frame and reel number of the recording. A Terminal Disclaimer for the present application relative to 10/466,031 is also enclosed. Withdrawal of the rejection of claims 7 and 9 to 11 for obviousness-type double patenting is respectfully requested.

4231/WGF:ar

- 11 -

- 5) The rejection of claims 7 and 9 under 35 U.S.C. §102(b) as being anticipated by US Patent 5,275,330 (Isaacs et al.) is respectfully traversed for the following reasons.
- 6) New main claim 12 and claims 13 to 22 remaining depending under claim 12 have been drafted to patentably distinguish the present invention from the prior art, particularly US Patent 5,275,330 (Isaacs et al.) and US Patent 4,493,856 (Kumar et al.).
- 7) It is the purpose of this invention to economize the production of printed circuit boards, particularly for power components while simultaneously assuring an efficient heat removal from power circuit components attached to the printed circuit board. Particularly, the filling of the thermal vias with a thermally conducting, but electrically insulating material has not been performed in an efficient manner heretofore. For example, British Patent Publication GB 2,304,999 A, of record, teaches to plug the thermal vias by "smearing an electrically nonconductive viscous polymer across the vias opening and thereby forcing the polymer (19) down into the opening to close the opening 17", (emphasis added), please see page 6 of this publication. The "smearing" operation is not very efficient. Additionally, the positioning of the thermally conducting and electrically insulating material in the vias is not very accurate if performed by smearing.
- 8) The invention avoids the above outlined problem by screen printing a viscous material such as a solid epoxy into the lead-through thermal vias, thereby closing the thermal vias to prevent solder of a following soldering step from passing through

4231/WGF:ar

- 12 -

the thermal vias. Further, the invention teaches applying the second metallization layer (17) outside the viscous material, but still inside the thermal vias, on the upper side (12) and on the under side (13) of the carrier body. These features have now been more clearly defined in new claim 12 and the claims 13 to 22 remaining dependent on new claim 12.

- 9) A reference to be anticipatory must show all the features of the claim under consideration. This is not the case with regard to US Patent 5,275,330 (Isaacs et al.). For instance it is stated in the Office Action on page 3, last paragraph that Isaacs et al. teach "two metallization layers (20, 22). In fact, Isaacs et al. has only one metallization layer (14) while the so-called metallization layers (20 and 22) are "lands 20, 22 are layers of metal contained within the MLPCB substrate 10 and pierced when via hole 11 is initially formed" (col. 5, lines 6 to 9) (emphasis added). More specifically, these lands are electrical conductors which are used for providing an electrical circuit or circuit elements, please see col. 5, lines 9 to 14 of Isaacs et al. Printed circuit electrical conductors within the substrate do not contribute to the heat dissipation and hence are not the equivalent of a first metallization coating (6) that covers the entire inner surface of the vias and a second metallization coating (17) positioned as outlined and claimed above. For this reason, Isaacs et al. do not anticipate the invention as now more clearly claimed.
- 10) Similar considerations apply to the "screen printed material (31)" because Isaacs et al. clearly disclose the screen printing material (31) as a solder contained within the vias (16, 17). Please see col. 6, line 25. The invention actually prevents

solder from flowing into the vias, which is not the case in Isaacs et al. Claim 12 clearly defines that the viscous material (8) is to prevent solder (which is used in a following soldering step) from passing through the lead-through vias. Furthermore, Isaacs et al. do not apply a second metallization layer (17) as expressly claimed in step d) of new claims 12. Summarizing, Isaacs et al. disclose the production of electrical through contacts rather than thermal vias that are filled with electrically nonconducting material, and on the other hand the claimed double metallization provides an efficient heat dissipation. Solder contacts are not the equivalent of electrically insulating filling material applied by screen printing. Therefore, withdrawal of the rejection of claims 7 and 9 under 35 U.S.C. §102(b) in view of Isaacs et al. is respectfully requested.

- 11) The rejection of claims 7, 8 and 9 under 35 U.S.C. §102(b) as being anticipated by US Patent 4,493,856 (Kumar et al.) is respectfully traversed for the following reasons.
- 12) It is true that Kumar et al. fill the vias (4) with a metal (3) to provide "circuit features 2 and 3", please see col. 5, line 55. Thus, Kumar et al. do not form two metallization layers as taught by the invention. Please see present Fig. 2 where the first metallization layer (6) is shown to pass entirely through the via (7) so as to cover both the top side of the substrate or carrier body and the bottom side of the substrate. According to the invention the second metallization step performed as defined in new claim 12, covers, at (17), the first metallization layer all the way into the vias (7) except where the thermally conductive, but electrically insulating screen printing material (8) such as a highly viscous epoxy is present. While it is true

4231/WGF:ar

- 14 -

that Kumar et al. describe two metallization steps that are applied to the substrate, more specifically to the surface thereof and not through the vias, it does not follow that Kumar et al. anticipate the claimed steps. The vias according to Kumar et al. are electrical through contacts, please see col. 1, lines 57 to 61. According to Kumar et al. it is necessary that the first metallization layer has a low melting point, more specifically lower than the melting point of the second metallization layer. After application of the second metallization layer, the substrate is heated to form an intermetallic connection which wets the metal on the substrate, but not the open or free areas of the substrate. The metallization layer on the free substrate areas is removed in an ultrasound bath or by sandblasting or with a wire brush, see col. 6, lines 33 to 36. Thus, there is no overall base metallization as is the case with the metallization layer (6) according to the invention. No electrically insulating and thermally conducting screen printing material is applied between the two metallization steps according to Kumar et al. The screen printing is only used for the application of the circuit structure on the substrate, please see col. 2, lines 47 to 51. This circuit structure is subsequently coated for protection and in order to be able to establish electrical conductors to the structural electrical components on the substrate. Thus, withdrawal of the rejection of claims 7, 8 and 9 as being anticipated in view of Kumar et al. is respectfully requested.

- 13) The remaining references have been reviewed and are considered to be less relevant than the references discussed above.

4231/WGF:ar

- 15 -

- 14) Applicants are aware of the references cited in US Serial Number 10/466,031. Those references that are relevant in the present application have been cited in applicants' Information Disclosure Statement on Form PTO-1449 dated November 16, 2001. These references are thus of record in the present application to the extent that they are relevant in the present application. Non-relevant or merely cumulative references have not been cited in the present application.
- 15) Favorable reconsideration and allowance of the application, including all present claims 12 to 22, are respectfully requested.

Respectfully submitted,

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Applicant

WGF:ar/4231
Enclosures:
copy of Assignment,
Form PTO-2038,
Terminal Disclaimer

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4231/WGF:ar

- 16 -